Amendments to the Claims:

Claims 1-24 have been amended. New claims 25-30 have been added. This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1   1. (Currently Amended) A method of analyzing intersections between objects in
2   computer animation comprising ~~the steps of~~:
3   providing a plurality of objects represented by a plurality of meshes, with each of
4   said plurality of objects being represented by one of said plurality of meshes and each of said
5   meshes being formed by a set of vertices, where a set of pairs of vertices of said set of vertices
6   define a set of edges;
7   checking all edges of said meshes to determine if said set of edges of said meshes
8   intersect with any of said plurality of meshes;
9   tracing an intersection path formed by intersection of said edges with any of said
10   plurality of meshes; ~~and~~
11   determining which vertices of said meshes are contained within said intersection
12   path; and ~~and setting a polarity of each of said contained vertices to indicate that those vertices~~
13   ~~are contained within said intersection path.~~
14   <u>setting a polarity of each vertex contained within said intersection path to indicate</u>
15   <u>that said vertex is contained within said intersection path, wherein a polarity of a vertex is set</u>
16   <u>based upon a number of disconnected regions formed by said intersection path.</u>

1   2. (Currently Amended) [[A]] <u>The</u> method of ~~analyzing intersections between~~
2   ~~objects according to~~ claim 1 wherein ~~said step of~~ determining which vertices of said meshes are
3   contained within said intersection path comprises examining vertices of a mesh that contains said
4   intersection path within a certain distance from a particular edge of said intersection path and
5   characterizing said vertices to determine which vertices of said meshes are contained within said
6   intersection path.

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1   3. (Currently Amended) [[A]] <u>The</u> method of ~~analyzing intersections between~~

2   ~~objects according to~~ claim 1 wherein ~~said step of~~ determining which vertices of said meshes are

3   contained within said intersection path comprises ~~the steps of~~:

4   selecting an arbitrary edge of a mesh that crosses said intersection path, where

5   said arbitrary edge is formed by vertices u and v and where said mesh contains said intersection

6   path;

7   performing a search of said mesh, radiating from one of said vertices u and v,

8   identifying all vertices in all of said edges that cross said intersection path, and defining the set of

9   vertices identified as a playpen;

10   tracing said intersection path and identifying vertices, within said playpen, on a

11   left side of said intersection path as left and retracing said intersection path in an opposite

12   direction and identifying vertices, with said playpen, on a right side of said intersection path as

13   right;

14   determining whether vertices adjacent to vertices identified as left and right lie

15   outside of said playpen;

16   discarding said intersection path when at least one of both left and right identified

17   vertices lie outside said playpen;

18   determining whether at least one vertex adjacent to said right identified vertices

19   lies outside said playpen; and

20   ~~changing said polarity of~~ <u>characterizing</u> each of said left identified vertices ~~to~~

21   ~~indicate that those vertices are~~ <u>as</u> contained within said intersection path when at least one vertex

22   adjacent to said right identified vertices lies outside said playpen and ~~changing said polarity of~~

23   <u>characterizing</u> each of said right identified vertices ~~to indicate that those vertices are~~ <u>as</u> contained

24   within said intersection path when at least one vertex adjacent to said left identified vertices lies

25   outside said playpen.

1   4. (Currently Amended) [[A]] <u>The</u> method of ~~analyzing intersections between~~

2   ~~objects according to~~ claim 1 wherein said intersection path is a self-intersection with the

3   intersection path being contained in a single mesh and <u>wherein</u> ~~said step of~~ setting a polarity of

4   each ~~vertex~~ <u>vertex</u> ~~of said contained vertices to indicate that those vertices are contained within said~~

5   ~~intersection path~~ comprises: ~~setting the~~

6   <u>associating a first</u> color ~~of said vertices that are~~ <u>with each vertex that is</u> contained

7   within said intersection path ~~to a predetermined color~~ when the intersection yields one region:

8   and

9   <u>when the intersection yields first and second disconnected regions,</u> ~~setting the~~

10 <u>associating a second</u> color ~~of vertices of a first portion of~~ <u>with each vertex contained in said first</u>

11 <u>disconnected region and associating a third color with each vertex contained in the second</u>

12 <u>disconnected region.</u> ~~said single mesh contained within said intersection path to a first color and~~

13 ~~setting the color of vertices of a second portion of said single mesh contained within said~~

14 ~~intersection path to a second color when the intersection yields two unconnected regions.~~

1   5. (Currently Amended) [[A]] <u>The</u> method of ~~analyzing intersections between~~

2   ~~objects according to~~ claim 1 wherein said intersection path is an intersection between a first

3   mesh and a second mesh and ~~said step of~~ <u>wherein</u> setting a polarity of each <u>vertex</u> ~~of said~~

4   ~~contained vertices to indicate that those vertices are contained within said intersection path~~

5   comprises ~~setting the~~ <u>associating a first</u> color [[of]] <u>with</u> vertices of the first mesh contained

6   within said intersection path ~~to a first color~~ and ~~setting the~~ <u>associating a second</u> color [[of]] <u>with</u>

7   vertices of the second mesh contained within said intersection path ~~to a second color~~.

1   6. (Currently Amended) [[A]] <u>The</u> method of ~~analyzing intersections between~~

2   ~~objects according to one of claims~~ <u>claim</u> 4 ~~and 5~~, further comprising displaying said objects on a

3   computer display with vertices ~~colored as said vertices have been set~~ <u>displayed in colors</u>

4   <u>associated with the vertices.</u>

1   7. (Currently Amended) A method of determining pinching between objects in

2   computer animation comprising ~~the steps of~~:

3   providing a plurality of objects represented by a plurality of meshes, with each of

4   said plurality of objects being represented by one of said plurality of meshes and each of said

5   meshes being formed by a set of vertices;

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6   determining an intersection path formed by ~~analyzing~~ intersections between said

7   objects ~~and changing a polarity of each of a plurality vertices contained in an intersection path~~

8   ~~created by an intersection of said plurality of meshes;~~

9   setting a polarity of each vertex contained within said intersection path based

10   upon a number of disconnected regions formed by said intersection path;

11   selecting a particular vertex of said set of vertices bound between surfaces of said

12   objects and closer to one of said surfaces, where said surfaces have defined insides and outsides

13   and said particular vertex is inside of both surfaces;

14   determining whether any vertices inside of said surfaces have their polarities set;

15   and

16   indicating that said particular vertex is pinched when any vertices inside of said

17   surfaces have their polarities set.

1   8. (Currently Amended) [[A]] The method of ~~determining pinching between~~

2   ~~objects in computer animation according to~~ claim 7 further comprising ~~the step of~~:

3   constraining motion of said pinched particular vertex when motion in said

4   computer animation is simulated.

1   9. (Currently Amended) [[A]] The method of ~~determining pinching between~~

2   ~~objects in computer animation according to~~ claim 7 wherein ~~said step of changing~~ setting a

3   polarity of each vertex ~~of a plurality vertices contained in an intersection path~~ comprises ~~setting~~

4   the associating a color ~~of each of a plurality vertices~~ with each vertex contained in ~~an~~ the

5   intersection path, the method ~~and~~ further comprising ~~the step of~~:

6   displaying said objects on a computer display with vertices ~~colored as said~~

7   ~~vertices have been set~~ displayed in colors associated with the vertices such that ~~an animator can~~

8   ~~see~~ the intersection and pinching of said objects is visually displayed.

1   10. (Currently Amended) A method of simulating motion of objects in computer

2   animation, the method comprising ~~the steps of~~:

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3   providing a plurality of objects represented by a plurality of meshes, with each of

4   said plurality of objects being represented by one of said plurality of meshes and each of said

5   meshes being formed by a set of vertices, where at least one of said objects is an animated object

6   and at least one of said objects is a simulated object;

7   positioning said objects at some time t to provide one frame of said computer

8   animation;

9   <u>determining an intersection path formed by</u> ~~analyzing~~ intersections between said

10 objects ~~and setting a polarity of each of a plurality vertices contained in an intersection path~~

11 ~~created by an intersection of said plurality of meshes;~~

12   <u>setting a polarity of each vertex contained within said intersection path based</u>

13 <u>upon a number of disconnected regions formed by said intersection path;</u>

14   setting a simulated force between vertices of said at least one simulated object

15 based on the polarity set for said vertices of said at least one simulated object; and

16   advancing the computer animation to a time $t + \Delta t$ and simulating motions of said

17 objects using said simulated force to simulate motions of said at least one simulated object.

1   11. (Currently Amended) [[A]] <u>The</u> method of ~~simulating motion of objects in~~

2   ~~computer animation according to~~ claim 10 wherein

3   when said intersection path is a self-intersection with the intersection path

4   contained in a single mesh, ~~said step of~~ setting <u>a polarity of each vertex contained within</u> ~~said~~

5   ~~polarity of each of said plurality vertices contained in~~ said intersection path comprises ~~setting the~~

6   <u>associating a first</u> color ~~of~~ <u>with</u> each <u>vertex contained within said intersection path</u> ~~of said~~

7   ~~plurality vertices to a predetermined color~~ when the intersection yields one region and <u>when the</u>

8   <u>intersection yields first and second disconnect regions, associating a second color with each</u>

9   <u>vertex contained in said first disconnected region and a third color with each vertex contained in</u>

10 <u>the second disconnected region,</u> ~~setting the color of vertices of a first portion of said single mesh~~

11 ~~contained within said intersection path to a first color and setting the color of vertices of a second~~

12 ~~portion of said single mesh contained within said intersection path to a second color when the~~

13 ~~intersection yields two unconnected regions,~~ and

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14   when said intersection path is an intersection between a first mesh and a second

15   mesh, ~~and said step of~~ setting a polarity of each <u>vertex</u> ~~of said plurality of vertices~~ contained in

16   said intersection path comprises ~~setting the~~ <u>associating the second</u> color ~~of each of said plurality~~

17   ~~vertices of~~ <u>with each vertex of</u> the first mesh <u>contained within said intersection path and</u>

18   <u>associating a third color with each vertex of the second mesh contained within said intersection</u>

19   <u>path.</u> ~~to said first color and setting the color of each of said plurality vertices of the second mesh~~

20   ~~to said second color.~~

1   12. (Currently Amended) [[A]] <u>The</u> method of ~~simulating motion of objects in~~

2   ~~computer animation according to~~ claim 11 wherein ~~said step of~~ setting a simulated force between

3   vertices of said at least one simulated object comprises:

4   setting said simulated force to cause an attraction between vertices of said at least

5   one simulated object when said vertices are ~~set to~~ <u>associated with</u> said ~~first or~~ second <u>or third</u>

6   colors;

7   setting said simulated force to cause [[an]] <u>a</u> repulsion between vertices of said at

8   least one simulated object when said vertices are not ~~set to~~ <u>associated with</u> said first <u>color, said</u>

9   second <u>color,</u> or ~~predetermined~~ <u>said third color</u> ~~colors~~; <u>and</u>

10   setting said simulated force to cause neither <u>an</u> attraction or <u>a</u> repulsion between

11   vertices of said at least one simulated object when said vertices are ~~set to~~ <u>associated with</u> said

12   ~~predetermined~~ <u>first</u> color.

1   13. (Currently Amended) A computer program product ~~comprising:~~ <u>stored on</u> a

2   computer ~~usable~~ <u>readable</u> medium ~~having computer readable program code means embodied in~~

3   ~~said medium for causing a computer to manipulate and analyze~~ <u>for processing</u> computer

4   generated objects, said computer ~~readable~~ program ~~code means~~ <u>product</u> comprising:

5   ~~means~~ <u>code</u> for providing a plurality of objects represented by a plurality of

6   meshes, with each of said plurality of objects being represented by one of said plurality of

7   meshes and each of said meshes being formed by a set of vertices, where a set of pairs of vertices

8   of said set of vertices define a set of edges;

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9   ~~means~~ code for checking all edges of said meshes to determine if said set of edges

10   of said meshes intersect with any of said plurality of meshes;

11   ~~means~~ code for tracing an intersection path formed by intersection of said edges

12   with any of said plurality of meshes; and

13   ~~means~~ code for determining which vertices of said meshes are contained within

14   said intersection path; and ~~and setting a polarity of each of said contained vertices to indicate~~

15   ~~that those vertices are contained within said intersection path.~~

16   code for setting a polarity of each vertex contained within said intersection path to

17   indicate that said vertex is contained within said intersection path, wherein a polarity of a vertex

18   is set based upon a number of disconnected regions formed by said intersection path.

1   14. (Currently Amended) [[A]] The computer program product ~~according to~~ of

2   claim 13 wherein ~~said means~~ the code for determining which vertices of said meshes are

3   contained within said intersection path comprises ~~means~~ code for examining vertices of a mesh

4   that contains said intersection path within a certain distance from a particular edge of said

5   intersection path and means for characterizing said vertices to determine which vertices of said

6   meshes are contained within said intersection path.

1   15. (Currently Amended) [[A]] The computer program product ~~according to~~ of

2   claim 13 wherein ~~said means~~ the code for determining which vertices of said meshes are

3   contained within said intersection path comprises:

4   ~~means~~ code for selecting an arbitrary edge of a mesh that crosses said intersection

5   path, where said arbitrary edge is formed by vertices u and v and where said mesh contains said

6   intersection path;

7   ~~means~~ code for performing a search of said mesh, radiating from one of said

8   vertices u and v, identifying all vertices in all of said edges that cross said intersection path, and

9   defining the set of vertices identified as a playpen;

10   ~~means~~ code for tracing said intersection path and identifying vertices, within said

11   playpen, on a left side of said intersection path as left and retracing said intersection path in an

12   opposite direction and identifying vertices, with said playpen, on a right side of said intersection

13   path as right;

14   means code for determining whether vertices adjacent to vertices identified as left

15   and right lie outside of said playpen;

16   means code for discarding said intersection path when at least one of both left and

17   right identified vertices lie outside said playpen;

18   means code for determining whether at least one vertex adjacent to said right

19   identified vertices lies outside said playpen; and

20   means code for changing said polarity of characterizing each of said left identified

21   vertices to indicate that those vertices are as contained within said intersection path when at least

22   one vertex adjacent to said right identified vertices lies outside said playpen and changing said

23   polarity of characterizing each of said right identified vertices to indicate that those vertices are

24   as contained within said intersection path when at least one vertex adjacent to said left identified

25   vertices lies outside said playpen.

1   16.   (Currently Amended) [[A]] The computer program product according to of

2   claim 13 wherein said intersection path is a self-intersection with the intersection path being

3   contained in a single mesh and said means the code for setting a polarity of each vertex of said

4   contained vertices to indicate that those vertices are contained within said intersection path

5   comprises: means for setting the

6   code for associating a first color of said vertices that are with each vertex that is

7   contained within said intersection path to a predetermined color when the intersection yields one

8   region; and

9   when the intersection yields first and second disconnected regions, means code

10   for setting the associating a second color with each vertex contained in said first disconnected

11   region and associating a third color with each vertex contained in the second disconnected

12   region. of vertices of a first portion of said single mesh contained within said intersection path to

13   a first color and setting the color of vertices of a second portion of said single mesh contained

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14   ~~within said intersection path to a second color when the intersection yields two unconnected~~

15   ~~regions.~~

1   17. (Currently Amended) [[A]] The computer program product ~~according to~~ of

2   claim 13 wherein said intersection path is an intersection between a first mesh and a second mesh

3   and ~~said means of~~ the code for setting a polarity of each vertex ~~of said contained vertices to~~

4   ~~indicate that those vertices are contained within said intersection path~~ comprises ~~means~~ code for

5   ~~setting the~~ associating a first color [[of]] with vertices of the first mesh contained within said

6   intersection path ~~to a first color~~ and code for associating a second ~~setting the~~ color [[of]] with

7   vertices of the second mesh contained within said intersection path ~~to a second color.~~

1   18. (Currently Amended) [[A]] The computer program product ~~according to~~ of

2   claim 16 ~~one of claims 16 and 17~~, further comprising ~~means~~ code for displaying said objects on a

3   computer display with vertices ~~colored as said vertices have been set~~ displayed in colors

4   associated with the vertices.

1   19. (Currently Amended) A computer program product ~~comprising;~~ stored on a

2   computer ~~usable~~ readable medium ~~having computer readable program code means embodied in~~

3   ~~said medium~~ for ~~causing a computer to manipulate and analyze~~ processing computer generated

4   objects in computer animation, said computer ~~readable~~ program product ~~code means~~ comprising:

5   ~~means~~ code for providing a plurality of objects represented by a plurality of

6   meshes, with each of said plurality of objects being represented by one of said plurality of

7   meshes and each of said meshes being formed by a set of vertices;

8   ~~means~~ code for determining an intersection path formed by ~~analyzing~~

9   intersections between said objects ~~and means for changing a polarity of each of a plurality~~

10 ~~vertices contained in an intersection path created by an intersection of said plurality of meshes;~~

11   code for setting a polarity of each vertex contained within said intersection path

12 based upon a number of disconnected regions formed by said intersection path;

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13   ~~means~~ <u>code</u> for selecting a particular vertex of said set of vertices bound between

14   surfaces of said objects and closer to one of said surfaces, where said surfaces have defined

15   insides and outsides and said particular vertex is inside of both surfaces;

16   ~~means~~ <u>code</u> for determining whether any vertices inside of said surfaces have

17   their polarities set; and

18   ~~means~~ <u>code</u> for indicating that said particular vertex is pinched when any vertices

19   inside of said surfaces have their polarities set.

1   20.   (Currently Amended) [[A]] <u>The</u> computer program product ~~according to~~ <u>of</u>

2   claim 19 further comprising:

3   ~~means~~ <u>code</u> for constraining motion of said pinched particular vertex when

4   motion in said computer animation is simulated.

1   21.   (Currently Amended) [[A]] <u>The</u> computer program product ~~according to~~ <u>of</u>

2   claim 19 wherein ~~said means for changing~~ <u>the code for setting</u> a polarity of each <u>vertex</u> ~~of a~~

3   ~~plurality vertices~~ contained in ~~an~~ <u>said</u> intersection path comprises ~~means~~ <u>code</u> for ~~setting the~~

4   <u>associating a</u> color ~~of each of a plurality vertices~~ <u>with each vertex</u> contained in ~~an~~ <u>said</u>

5   intersection path<u>, the computer program product</u> ~~and~~ further comprising[[:]] ~~means~~ <u>code</u> for

6   displaying said objects on a computer display with vertices <u>displayed in colors associated with</u>

7   <u>the vertices</u> ~~colored as said vertices have been set~~ such that ~~an animator can see~~ the intersection

8   and pinching of said objects <u>is visually displayed.</u>

1   22.   (Currently Amended) A computer program product ~~comprising:~~ <u>stored on a</u>

2   computer <u>readable</u> ~~usable~~ medium ~~having computer readable program code means embodied in~~

3   ~~said medium for causing a computer to manipulate and analyze~~ <u>for processing</u> computer

4   generated objects in computer animation, said computer ~~readable~~ program <u>product</u> ~~code means~~

5   comprising:

6   ~~means~~ <u>code</u> for providing a plurality of objects represented by a plurality of

7   meshes, with each of said plurality of objects being represented by one of said plurality of

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8   meshes and each of said meshes being formed by a set of vertices, where at least one of said

9   objects is an animated object and at least one of said objects is a simulated object;

10   ~~means~~ <u>code</u> for positioning said objects at some time *t* to provide one frame of

11   said computer animation;

12   ~~means~~ <u>code</u> for <u>determining an intersection path formed by</u> ~~analyzing~~

13   intersections between said objects ~~and setting a polarity of each of a plurality vertices contained~~

14   ~~in an intersection path created by an intersection of said plurality of meshes;~~

15   <u>code for setting a polarity of each vertex contained within said intersection path</u>

16   <u>based upon a number of disconnected regions formed by said intersection path;</u>

17   ~~means~~ <u>code</u> for setting a simulated force between vertices of said at least one

18   simulated object based on the polarity set for said vertices of said at least one simulated object;

19   and

20   ~~means~~ <u>code</u> for advancing the computer animation to a time *t* + Δ*t* and simulating

21   motions of said objects using said simulated force to simulate motions of said at least one

22   simulated object.

1   23. (Currently Amended) [[A]] <u>The</u> computer program product ~~according to~~ <u>of</u>

2   claim 22 wherein

3   when said intersection path is a self-intersection with the intersection path

4   contained in a single mesh, said ~~means~~ <u>code</u> for setting <u>a polarity of each vertex contained within</u>

5   ~~said polarity of each of said plurality vertices contained in~~ said intersection path comprises

6   ~~means~~ <u>code</u> for <u>associating a first color with each vertex contained within said intersection path</u>

7   ~~setting the color of each of said plurality vertices to a predetermined color~~ when the intersection

8   yields one region and <u>when said intersection path yields first and second disconnected regions,</u>

9   <u>code for associating a second color with each vertex contained in said first disconnected region</u>

10   <u>and a third color with each vertex contained in the second disconnected region,</u> ~~setting the color~~

11   ~~of vertices of a first portion of said single mesh contained within said intersection path to a first~~

12   ~~color and setting the color of vertices of a second portion of said single mesh contained within~~

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13 ~~said intersection path to a second color when the intersection yields two unconnected regions,~~

14 and

15   when said intersection path is <u>formed from</u> an intersection between a first mesh

16 and a second mesh, <u>the code for</u> ~~said means for~~ setting a polarity of each <u>vertex</u> ~~of said plurality~~

17 ~~of vertices~~ contained in said intersection path comprises ~~means~~ <u>code</u> for ~~setting the~~ <u>associating</u>

18 <u>the second</u> color ~~of each of said plurality vertices~~ <u>with each vertex</u> of the first mesh ~~to said first~~

19 ~~color~~ and ~~setting the~~ <u>associating the third</u> color <u>with</u> ~~of~~ each ~~of said plurality vertices~~ <u>vertex</u> of

20 the second mesh ~~to said second color~~.

1   24. (Currently Amended) [[A]] <u>The</u> computer program product ~~according to~~ <u>of</u>

2 claim 23 wherein ~~said means for~~ <u>the code for</u> setting a simulated force between vertices of said at

3 least one simulated object comprises:

4   ~~means~~ <u>code</u> for setting said simulated force to cause an attraction between vertices

5 of said at least one simulated object when said vertices are ~~set to~~ <u>associated with</u> said ~~first or~~

6 second <u>or third</u> colors;

7   ~~means~~ <u>code</u> for setting said simulated force to cause [[an]] <u>a</u> repulsion between

8 vertices of said at least one simulated object when said vertices are not ~~set to~~ <u>associated with</u> said

9 first <u>color,</u> <u>said</u> second <u>color,</u> or ~~predetermined~~ <u>said third</u> color ~~colors~~; <u>and</u>

10   ~~means~~ <u>code</u> for setting said simulated force to cause neither <u>an</u> attraction or <u>a</u>

11 repulsion between vertices of said at least one simulated object when said vertices are ~~set to~~

12 <u>associated with</u> said ~~predetermined~~ <u>first</u> color.

1   25. (New) The method of claim 5, further comprising displaying said objects

2 on a computer display with vertices displayed in colors associated with the vertices.

1   26. (New) The computer program product of claim 17, further comprising

2 code for displaying said objects on a computer display with vertices displayed in colors

3 associated with the vertices.

1   27. (New) A method of analyzing intersections, the method comprising:

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2   determining an intersection path formed by an intersection of a first mesh portion

3   and a second mesh portion, wherein each mesh portion comprises a plurality of vertices;

4   determining a set of vertices of the first mesh portion and the second mesh portion

5   that are contained within the intersection path; and

6   setting a value for each vertex in the set of vertices based upon based upon a

7   number of disconnected regions formed by said intersection path.

1   28.   (New) The method of claim 27 wherein the first mesh portion and the

2   second mesh portion are portions of a mesh representing an object.

1   29.   (New) The method of claim 27 wherein the first mesh portion is a portion

2   of a first mesh representing a first object and the second mesh portion is a portion of a second

3   mesh representing a second object.

30.   (New) The method of claim 27 wherein setting a value for each vertex in the set of vertices comprises:

setting each vertex in the set of vertices to a first value if a single region is formed by the intersection path; and

if the intersection path forms a first region on the first mesh portion and a second region on the second mesh portion that is disconnected from the first region,

setting each vertex in the set of vertices that is in the first region to a second value, and

setting each vertex in the set of vertices that is in the second region to a third value.